

N O T I C E

THIS DOCUMENT HAS BEEN REPRODUCED FROM
MICROFICHE. ALTHOUGH IT IS RECOGNIZED THAT
CERTAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RELEASED
IN THE INTEREST OF MAKING AVAILABLE AS MUCH
INFORMATION AS POSSIBLE

1
is available under NASA sponsorship
in the interest of early and wide dis-
semination of Earth Resources Survey
data information and without liability
to the user.

80-10005

CR-162382

Geologic Application of
Thermal-inertia Mapping from Satellite

Type II Progress Report
June - August 1979

(E80-10005) GEOLOGIC APPLICATION OF
THERMAL-INERTIA MAPPING FROM SATELLITE
Progress Report, 1 Jun. - 31 Aug. 1979
(Geological Survey) 14 p HC A02/MF A01

N80-12521

Unclas
CSCL 08B G3/43 00005

Prepared for
Goddard Space Flight Center
Greenbelt, Maryland 20771

Submitted by
Terry W. Offield, Principal Investigator
U.S. Geological Survey, Denver, Colorado 80225

Prepared by
Susanne H. Miller and Kenneth Watson
U.S. Geological Survey, Denver, Colorado 80225



TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Geologic applications of thermal-inertia mapping from satellite		5. Report Date	
		6. Performing Organization Code	
7. Author(s) Susanne H. Miller and Kenneth Watson		8. Performing Organization Report No.	
9. Performing Organization Name and Address U.S. Geological Survey Petrophysics and Remote Sensing Branch Box 25046 Federal Center, Stop 964 Denver, Colorado 80225		10. Work Unit No.	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address James C. Broderick HCMM Investigative Support Goddard Space Flight Center, Code 902.6 Greenbelt, Maryland 20771		13. Type of Report and Period Covered Type II Progress Report June 1 - August 31, 1979	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract <p>A topographically registered thermal-inertia image was constructed using USGS aircraft data. The image is centered on a latitude of 43°27' and extends from 105°29' to 105°35' longitude with a swath width of 7 km.</p> <p>REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR</p>			
17. Key Words (Selected by Author(s))		18. Distribution Statement	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*

*For sale by the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

Figure 2. Technical Report Standard Title Page

A. Problems

The HCMM data products received include 153 black and white screening prints, one useable night thermal CCT over the Powder River Basin, WY, and one day thermal and visible CCT over Cabeza Prieta in Arizona. We have not received a day/night data set pair (CCT's) with which to conduct our thermal-inertia investigation.

B. Accomplishments

USGS scanner data, on an east/west line of latitude $43^{\circ}27'$, were digitized from $105^{\circ}29'$ to $105^{\circ}35'$ longitude. These data represent the segment directly west of the thermal-inertia image constructed during the last reporting period. This new data segment was processed in similar manner, and a relative thermal-inertia image was constructed from the products. This relative image was registered to a topographic base and is in the process of being concatenated to the eastern thermal-inertia image.

CCTs from two different scenes were received during this period and reformatted to be compatible with the USGS Honeywell computer. One scene was a nighttime thermal image of the Powder River Basin, WY site. The other was a daytime thermal and visible pair of the Cabeza Prieta area in Arizona. We are awaiting the corresponding CCTs which will complete the day/night pair for each scene.

We are investigating using data over large water bodies to determine the magnitude of the atmospheric attenuation/emission effect. This technique has been applied to the aircraft data with considerable success. The major limitation appears to be the availability of water bodies of sufficient size. It was determined that the scan angle across the Great Salt Lake does not change significantly enough to calculate an extrapolated surface temperature within acceptable error limits. This method does not appear promising for atmospheric calibration of satellite thermal data.

C. Significant Results

The significant results from this report period are: constructed topographically registered relative thermal-inertia image of a portion of the Powder River Basin, WY, using USGS aircraft data. This segment is directly west of the image constructed during the last reporting period.

For further details, see the accomplishment section.

D. Publications and Presentations

Ken Watson was an invited speaker at the Gordon Research Conference held August 20-24, at Plymouth, NH. The title of the conference was "Remote Sensing of the Earth's Surface".

E. Recommendations

None

F. Funds Expended

Total expenditures to date: \$71,838

G. Data Utility

A list of the HCMM data products received to date is submitted with this report.

SITE: Wyoming - Powder River Basin

HCMH DATA PRODUCTS

DATE: May/June 1978

Date	Data		Product		% Site Covered								% Site Cloud Covered				DN Range		Ratings		Pairs?		Scene ID	Rema s
	Day Vis	Nite Ir	B&W	Trans	CCT	<10	10	25	50	75	100	<10	10-30	60	90	Low	High	Unsat	Mar	Sat	Yes	No	AA Number	
5/11	x	x	x	x	x					x			x					x			x	x	0015-20220-1 0015-20220-2	RMS 277 RMS 278
6/8	x		x	x			x						x			13	130	x					0043-20450-1 0043-20450-2 0043-20430-1 0043-20430-2 0043-09480-3 0043-09490-3	NW section -do- SW section -do- NW tip SW tip, good image of Salt Lake
6/11	x	x	x	x			x									22	181	x			x	x	0046-20020-1 0046-20020-1	NE section -do-
6/12	x		x	x				x						x		20	121	x			x		0047-20190-1 0047-20190-2 0047-20200-1 0047-20200-2	SE corner -do- Northern 75% -do-
6/17		x	x	x									x			16	193	x			x	x	0052-20120-2 0052-20130-1 0052-20130-2	SE tip SE section -do-
6/18	x		x	x												19	172	x					0053-20310-1 0053-20310-2	
6/28	x		x	x			x						x			20	199		x		x		0063-20170-1 0063-20170-2 0063-20190-1 0063-20190-2	Southern end -do- Northern half -do-
6/29			x	x												1	71	x			x		0064-09390-3	NW tip

SITE: Wyoming - Powder River Basin

DATE: July 1978

Date	Data		Product		% Site Covered				% Site Covered			DN Range		Ratings		Pairs?		Scene ID	Remarks					
	Day Vis	Nite IR	B&W	Trans	CCT	<10	10	25	50	75	100	<10	10-30	60	90	Low	High	Unsat	Mar	Set	Yes	No	AA Number	
7/2	x		x	x				x					x			7	133	x			x		0067-19540-2	NE corner -do-
			x	x				x					x			15	168	x			x		0067-19560-1	
7/8	x		x	x				x					x			17	202	x			x		0073-20050-1	SE corner -do-
			x	x				x					x			3	149	x			x		0073-20050-2	
7/13	x		x	x				x					x			16	146	x			x		0078-19570-1	NE corner -do-
			x	x				x					x			13	131	x			x		0078-19570-2	NE quad
			x	x				x					x			4	64	x			x		0078-09020-3	
7/18	x		x	x				x					x			11	192	x			x		0083-19510-1	
			x	x				x					x			3	151	x			x		0083-19510-2	
7/20			x	x				x					x			2	55	x			x		0085-09290-3	NW tip Missing SE part
			x	x				x					x			2	76				x		0085-09310-3	
7/24			x	x				x					x			9	68				x		0089-09060-3	No western edge
			x	x				x					x			24	54	x			x		0089-20010-1	
			x	x				x					x			32	169	x			x		0089-20010-2	
7/25			x	x				x					x			2	64	x			x		0090-09230-3	SW corner
			x	x				x					x			4	72	x			x		0090-09250-3	
7/30			x	x				x					x			6	56				x		0095-01170-3	Good data, possibly meteorologically anomalous SE tip -do-
			x	x				x					x			12	209	x			x		0095-20110-1	Missing SE tip
			x	x				x					x			4	145	x			x		0095-20110-2	-do-
			x	x				x					x			12	172				x		0095-20130-1	Missing SE tip
			x	x				x					x			3	136	x			x		0095-20130-2	-do-

HCMH DATA PRODUCTS

SITE: Wyoming - Powder River Basin

DATE: August 1978

Date	Data		Product	% Site Covered						% Site Covered			DN Range	Ratings		Pairs?		Scene ID	Remarks	
	Day Vis	Nite Ir		<10	10	25	50	75	100	<10	10-30	60		90	Unsat	Mar	Sat			Yes
			B&W	Trans	CCT															
8/5		x x	x x	x															0101-09270-3 0101-09280-3	Very clear SW tip, clear over Salt Lake
8/10		x x	x x	x															0106-09210-3 0106-09200-3	SW tip
8/15		x	x	x															0111-09120-3 0111-09140-3 0111-20080-1 0111-20080-2 0111-20090-1 0111-20090-2	No. half, clear only near Sheridan SW tip only So. boundary -do-
8/19		x x	x x	x															0115-08470-3 0115-08480-3	Barely gets the E edge Only gets the SE tip
8/25		x	x	x															0121-19550-1 0121-19550-2	Data not cloud covered, had noise problems -do-
8/31		x x	x x	x															0127-20060-2 0127-20060-1 0127-20070-1 0127-20070-2	No. border -do-

SITE: Wyoming - Powder River Basin

HCM DATA PRODUCTS

DATE: September 1978

Date	Data		Product		% Site Covered					% Site Covered		DN Range	Ratings		Pairs?		Scene ID	Remarks
	Day Vis	Nite Ir	B&W	Trans	CCT	<10	10	25	50	75	:00		Low	High	Unsat	Mar	Sat	
9/5	x	x	x	x	x	x	x	x	x	x	x	3	71	x	x	x	0132-09630-3	No. border
	x	x	x	x	x	x	x	x	x	x	x	15	72	x	x	x	0132-09050-3	Very clear
	x	x	x	x	x	x	x	x	x	x	x	26	49	x	x	x	0132-19590-1	SE area
	x	x	x	x	x	x	x	x	x	x	x	23	153	x	x	x	0132-19590-2	-do-
	x	x	x	x	x	x	x	x	x	x	x	13	152	x	x	x	0132-20010-1	Large data dropout in northern part of site
	x	x	x	x	x	x	x	x	x	x	x	2	145	x	x	x	0132-20010-2	Clouds may be problem in day
9/6	x	x	x	x	x	x	x	x	x	x	x	2	74	x	x	x	0133-09220-3	No. half
	x	x	x	x	x	x	x	x	x	x	x	3	72	x	x	x	0133-09230-3	So. half, missing eastern part
9/10	x	x	x	x	x	x	x	x	x	x	x	12	137	x	x	x	0137-19530-2	SE quarter
	x	x	x	x	x	x	x	x	x	x	x	14	168	x	x	x	0137-19530-1	-do-
9/26	x	x	x	x	x	x	x	x	x	x	x	1	24	x	x	x	0153-08560-3	NE quarter
	x	x	x	x	x	x	x	x	x	x	x	1	26	x	x	x	0153-08580-3	SE quarter
	x	x	x	x	x	x	x	x	x	x	x	15	77	x	x	x	0153-19530-1	-do-
	x	x	x	x	x	x	x	x	x	x	x	1	129	x	x	x	0153-19530-2	-do-
	x	x	x	x	x	x	x	x	x	x	x	10	96	x	x	x	0153-19540-1	NE portion
	x	x	x	x	x	x	x	x	x	x	x	1	133	x	x	x	0153-19540-2	-do-
9/27	x	x	x	x	x	x	x	x	x	x	x	10	41	x	x	x	0154-09140-3	No. border
	x	x	x	x	x	x	x	x	x	x	x	12	43	x	x	x	0154-09160-3	Very good, RMS 281
	x	x	x	x	x	x	x	x	x	x	x	4	39	x	x	x	0154-20100-1	So. edge
	x	x	x	x	x	x	x	x	x	x	x	41	68	x	x	x	0154-20100-2	-do-
	x	x	x	x	x	x	x	x	x	x	x	2	25	x	x	x	0154-20110-1	RMS 283
	x	x	x	x	x	x	x	x	x	x	x	39	64	x	x	x	0154-20110-2	RMS 283, scene mislabeled, is over ocean

SitE: Wyoming - Powder River Basin

HCHM DATA PRODUCTS

DATE: October 1978

Date	Data		Product	% Site Covered						% Site Cloud Covered			DN Range		Ratings		Pairs?		Scene ID	Remarks					
	Day Vis	Nite Ir		B&W	Trans	CCT	<10	10	25	50	75	100	<10	30	60	90	Low	High			Unsat	Mar	Sat	Yes	No
10/3				x	x																			0160-09260-3 0160-09280-3	NW tip SW tip
10/6				x	x																			0163-08430-3	SE tip
10/7	x			x	x																			0164-19570-1 0164- 9570-2	SE quarter -do-
10/19				x	x																			0176-09230-3 0176-09250-3	NW corner SW corner
10/23	x			x	x																			0180-19540-1 0180-19540-2	Large data dropout in No. half, missing western part -do-
10/24				x	x																			0181-09160-3 0181-20120-1 0181-20120-2	May be clouds in So. part
10/28				x	x																			0185-19480-3 0185-08510-3 0185-19460-3	NE corner, must be day vis? Strange scene ID Can't locate, must be day IR?
10/29				x	x																			0186-09080-3 0186-09100-3	SW tip
10/30				x	x																			0187-09260-3	NW tip

HCHM DATA PRODUCTS

DATE: November 1978

SITE: Wyoming - Powder River Basin

Site: Wyoming - Powder River Basin

Date	Data		Product	X Site Covered					X Site Cloud Covered					DN Range		Ratings		Pairs?		Scene ID	Remarks			
	Day Vis	Nite IR	B&W Trans	CCT	<10	10	25	50	75	100	<10	10	30	60	90	Low	High	Unsat	Mar	Lat	Yes	No	AA Number	
11/3		X	X	X							X	X				2	37		X		X		0191-09010-3	Image entirely black, may be snow covered
11/14		X	X	X							X	X				2	7		X		X		0202-09050-3	Only water visible, rest of image black
	X		X	X	X	X					X	X	X			15	119	X			X	X	0202-20000-1	So. border
		X	X	X	X	X						X	X			3	33	X			X	X	0202-20000-2	-do-
	X		X	X					X			X	X			14	92		X		X	X	0202-20020-1	May be snow covered?
11/15	X		X	X					X			X				8	94		X		X		0203-20200-1	NW portion, looks like snow
			X	X				X				X				2	27		X		X		0203-20200-2	-do-
11/23		X	X	X	X						X	X				2	10	X			X		0211-08340-3	NE tip, very cold?
		X	X	X	X						X	X				2	15	X			X		0211-08360-3	SE tip, very cold?
11/24		X	X	X					X			X	X			2	10		X		X		0212-08530-3	Very cold?
		X	X	X							X	X				2	10	X			X		0212-08550-3	-do-
11/25		X	X	X					X			X				2	14		X		X		0213-09110-3	Very cold?

SITE: Wyoming - Powder River Basin

HCHH DATA PRODUCTS

DATE: April 1979

DATE: April 1979

Date	Data			Product			% Site Covered					% Site Cloud Covered			DN Range		Ratings		Pairs?		Scene ID	Remarks				
	Day	Day	Nite	B&W	Trans	CCT	<10	10	25	50	75	100	<10	30	60	90	Low	High	Unsat	Mar	Sat	Yes	No	AA Number		
4/1	x		x	x	x				x								48	175	x			x		0340-19310-1 0340-19310-2	Scene temp. about 260°K	
		x		x	x				x								2	121	x			x				
			x	x	x					x							37	149	x			x		0340-19330-1 0340-19330-2	Av. scene temp. about 260°K	
				x	x					x							2	118	x			x				
4/17	x		x	x	x				x								21	182	x			x		0356-19290-1 0356-19290-2		
		x		x	x				x								2	111	x			x				
			x	x	x					x							17	161	x			x		0356-19310-1 0356-19310-2		
				x	x					x							2	99	x			x				

HCHM DATA PRODUCTS

SITE: Arizona - Cabeza Prieta

DATE: May and August 1978

Date	Data		Product		Σ Site Covered					Σ Site Cloud Covered			DN Range		Ratings		Pairs?		Scene ID	Remarks				
	Day Vis	Day Mite IR	B&W	Trans	CCT	<10	10	25	50	75	100	<10	10-30	60	90	Low	High	Unsat	Mar	Sat	Yes	No	AA Number	
5/30	x		x	x	x						x	x									x		0034-21130-1	Received day IR CCT; data too garbled to use. NASA says data not recoverable. RMS 280.
8/2	x	x	x	x	x						x	x				7	208	x			x		0098-21030-1 0098-21030-2	
8/5		x	x	x	x						x					3	89				x		0101-09300-3 0101-09320-3	
8/7	x		x	x	x						x					8	156				x		0103-20550-1	RMS 282. Lower 25% of site
	x		x	x	x						x					1	155				x		0103-20550-2 0103-20570-1	-do- RMS 282. Upper 75% of site
		x	x	x	x						x					1	175				x		0103-20570-2	-do-
8/10		x	x	x							x					2	82				x		0106-09230-3	
8/17	x	x	x	x	x						x	x				14	194	x			x		0113-20420-1 0113-20420-2 0113-09520-3	Eastern half -do- Ground track must have been off to get this. It isn't Aug. 17!
8/28	x	x	x	x	x						x					8	180				x		0124-20460-1 0124-20460-2	

SITE: Arizona - Cabeza Prieta

HCHN DATA PRODUCTS

DATE: September 1978

Date	Data		Product		Σ Site Covered					Σ Site Cloud Covered			DN Range		Ratings		Pairs?		Scene ID	Remarks			
	Day Vis	Nite Ir	B&W	Trans CCT	<10	10	25	50	75	100	<10	10-30	60	90	Low	High	Unsat	Mar			Sat	Yes	No
9/3	x		x	x						x		x			8	182		x		x		0130-20570-1	Puffy clouds may be ~20% -do-
		x	x	x						x		x			1	143		x		x		0130-20570-2	
9/6		x	x	x						x			x		10	89				x	x	0133-09250-3	So. portion -do- NW tip -do-
			x	x									x		3	88		x		x	x	0133-09270-3	
9/14	x	x	x	x								x	x		4	161				x		0141-21030-1	
	x		x	x						x		x	x		31	144		x		x	x	0141-21030-2	
	x	x	x	x						x		x	x		9	195				x	x	0141-21050-1	
		x	x	x						x		x	x		2	131				x	x	0141-21050-2	
9/18		x	x	x						x			x		1	66				x		0145-09490-3	NW tip SW tip Eastern 75% -do-
		x	x	x						x		x			39	68				x		0145-09500-3	
	x		x	x						x		x			11	113		x		x	x	0145-20390-1	
		x	x	x						x		x			4	150				x	x	0145-20390-2	
9/27		x	x	x						x		x			25	82				x		0154-09190-3	Eastern 75%
9/30	x	x	x	x						x			x		3	165				x		0157-21020-1	Western 75% -do-
			x	x						x		x			3	158		x		x	x	0157-21020-2	

HC-14 DATA PRODUCTS

SITE: Arizona - Cabeza Prieta

DATE: March and April 1979

Date	Data		Product		% Site Covered					% Site Cloud Covered		DN Range		Ratings			Pairs?		Scene ID	Remarks				
	Day Vis	Nite Ir	B&W	Trans	CCT	<10	10	25	50	75	100	<10	30	60	90	Low	High	Unsat			Mar	Sat	Yes	No
3/31	x		x	x		x						x				4	129	x			x		0339-20470-1	SW tip, clear over Salton Sea -do-
		x	x	x		x						x				27	129	x			x		0339-20470-2	
4/15	x	x	x	x						x	x	x				6	113			x	x	x	0354-20270-1	0354-20270-2
			x	x						x	x	x				6	164			x	x	x		